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Nematodes Collected from Rodents on Uotsuri Island, Okinawa, Japan

HIDEO HASEGAWA,[1] SHUSEI ARAI,[2] AND SATOSHI SHIRAISHI[3]

[1] Department of Parasitology and Research Center of Comprehensive Medicine, School of Medicine, University of the Ryukyus, Nishihara, Okinawa 903-01, Japan,
[2] General Laboratory Center, Kyushu Dental College, Kokura-kita-ku, Kitakyushu 803, Japan, and
[3] Department of Zoology, Faculty of Agriculture, Kyushu University, Hakozaki, Fukuoka 812, Japan

ABSTRACT: Nematodes parasitic in rodents on Uotsuri Island, Okinawa, Japan, were studied with special reference to the zoogeography of the hosts and parasites. *Strongyloides ratti, Capillaria bacillata, Nippostrongylus brasiliensis, Syphacia muris, Heterakis spumosa, Cyathospirura seurati, Pterygodermatites tani, Pterygodermatites whartoni,* and *Physaloptera* sp. were collected from *Rattus rattus. Heligmonoides* sp. and *Physaloptera* sp. were detected from *Apodemus agrarius. Cyathospirura seurati* was recorded for the first time from the Far East and is redescribed. *Cyathospirura dasyuridis* is synonymized with *C. seurati.* An hypothesis is presented that males of *P. tani* exhibit 2 morphological types, one of which has been regarded as *P. whartoni. Heligmonoides* sp. and *Physaloptera* sp. are presumed to have been introduced to Uotsuri Island with *A. agrarius.*

KEY WORDS: Nematoda, *Rattus rattus, Apodemus agrarius,* Uotsuri Island, Okinawa, Japan, zoogeography.

Uotsuri Island (=Uotsuri-jima) (about 4 km², with a maximum elevation of 363 m) is the largest island of the Senkaku Islands, which lie about 175 km north of Ishigaki Island (Fig. 1). This island has been uninhabited except for the period from the end of the last century to World War II, during which Japanese people were stationed there yearly for the collection of albatross feathers and for making dried bonitoes and stuffed specimens of marine birds (Midorima, 1984). Uotsuri Island is of mammalogical interest because of the occurrence of *Nesoscaptor uchidai,* a mole of extremely ancient origin (Abe et al., 1991), and *Apodemus agrarius,* a field mouse that seems to have arrived relatively recently (Arai and Shiraishi, unpubl.). Besides these species, 2 introduced mammals, roof rat (*Rattus rattus*) and goat (*Capra hircus*), inhabit the island (Shiraishi and Arai, 1980). The helminths of mammals on this island have not been investigated previously. Recently we had an opportunity to examine the nematodes from rodents collected on Uotsuri Island and found several species of parasitological and zoogeographical interest.

Materials and Methods

Rodents were trapped in 1979 on Uotsuri Island by the junior authors. The methods of trapping have already been reported (Shiraishi and Arai, 1980). Captured rodents were anesthetized to death with ether, and their viscera were resected and fixed in 70% ethanol. They were examined for helminths under a dissecting microscope. Collected nematodes were cleared in glycerin–alcohol or creosote for microscopical observation. Figures were made with the aid of a drawing tube on a Nikon Optiphoto microscope. Measurements are in micrometers unless otherwise stated. All specimens have been deposited in the National Science Museum, Tokyo (NSMT).

The following material was also examined for comparison: (1) *Cyathospirura* sp., 4 males and 4 females, from *Vulpes vulpes* from Frankston, Victoria, Australia, courtesy of Dr. Ian Beveridge; (2) *Cyathospirura dasyuridis* Mawson, 1968, paratypes, 1 male and 1 female, from *Dasyurops maculatus* from New South Wales, South Australian Museum AHC5194; and (3) *C. dasyuridis,* 4 males, from *Dasyurus quoll* from Tasmania, South Australian Museum AHC6987.

Results

The alimentary canals of 12 *Rattus rattus* and 2 *Apodemus agrarius* were examined. The nematodes were recorded, and their prevalence and intensity of infection are shown in Table 1. Among these species, *Strongyloides ratti* Sandground, 1925, *Capillaria bacillata* (Eberth, 1863), *Nippostrongylus brasiliensis* (Travassos, 1914), and *Heterakis spumosa* Schneider, 1866, are cosmopolitan nematodes of *R. rattus.* Description or remarks are made for other species below.

Cyathospirura seurati Gibbs, 1957

Syn. *Cyathospirura dasyuridis* Mawson, 1968, comb. n.

(Nematoda: Spiruroidea: Spiruridae) (Figs. 2–11)

GENERAL: Body small but stout (Fig. 2). Mouth grossly hexagonal, lacking labium (Figs. 3–5). Four cephalic double papillae and amphidial pores forming outer circle, and 6 minute pa-

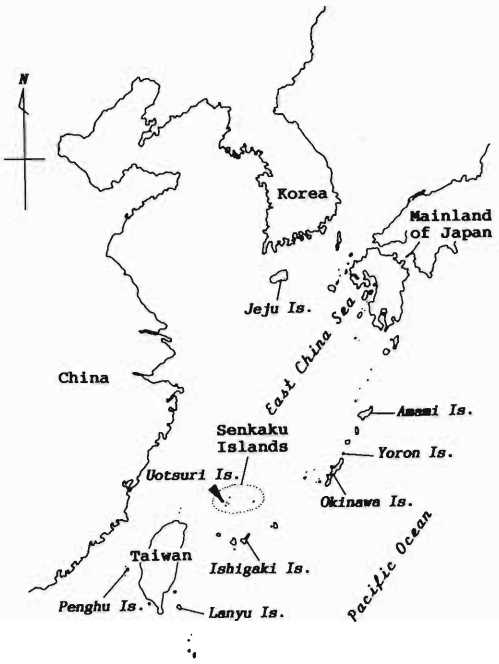


Figure 1. Geographical location of Uotsuri Island, Okinawa, Japan. Localities of adjacent areas referred to in the text are also presented.

pillae forming inner circle (Figs. 3–5). Buccal capsule well developed, thick-walled, with 8 teeth, of which dorsoventral and lateral ones larger (Figs. 3–5). Esophagus divided into anterior muscular and posterior glandular portions (Fig. 2). Nerve ring near posterior end of muscular esophagus (Fig. 2). Deirids asymmetrically positioned: right deirid posterior to nerve ring; left deirid anterior to nerve ring (Fig. 2). Narrow lateral alae commencing anterior to nerve ring and ending anterior to anus. Excretory pore at junction between muscular and glandular portions of esophagus (Fig. 2).

MALE (4 specimens): Posterior part coiled ventrad. Perianal cuticle ornamented with numerous interrupted longitudinal ridges (Fig. 6). Large caudal alae supported dorsally by numerous transverse muscle fibers present. Preanal papillae pedunculate with 4 pairs in 2 groups; unpaired midventral papilla slightly anterior to anus. Postanal papillae 6 pairs: 1 pair pedunculate, projecting midventrally immediately posterior to anus; 1 pair pedunculate at midtail; 4 minute sessile pairs grouped with phasmidial pores near tail tip (Fig. 6). Left spicule slender, filiform, with pointed tip; right spicule stout, with round tip (Fig. 7). Gubernaculum small, triangular in lateral view (Figs. 7–9). Tail conical. Measurements are presented in Table 2 compared to those of Australian material.

FEMALE (2 specimens): Body slender, tapered to both extremities. Vulva at midbody. Vagina narrow, directed dorsad and then running posteriad. Tail conical with blunt tip (Fig. 10). Eggs ellipsoidal, thick-shelled, with weak swellings at poles, containing developed larvae (Fig. 11). Measurements are presented in Table 2 compared to those of Australian material.

HOST: *Rattus rattus.*

SITE IN HOST: Stomach.

LOCALITY: Uotsuri Island, Okinawa, Japan.

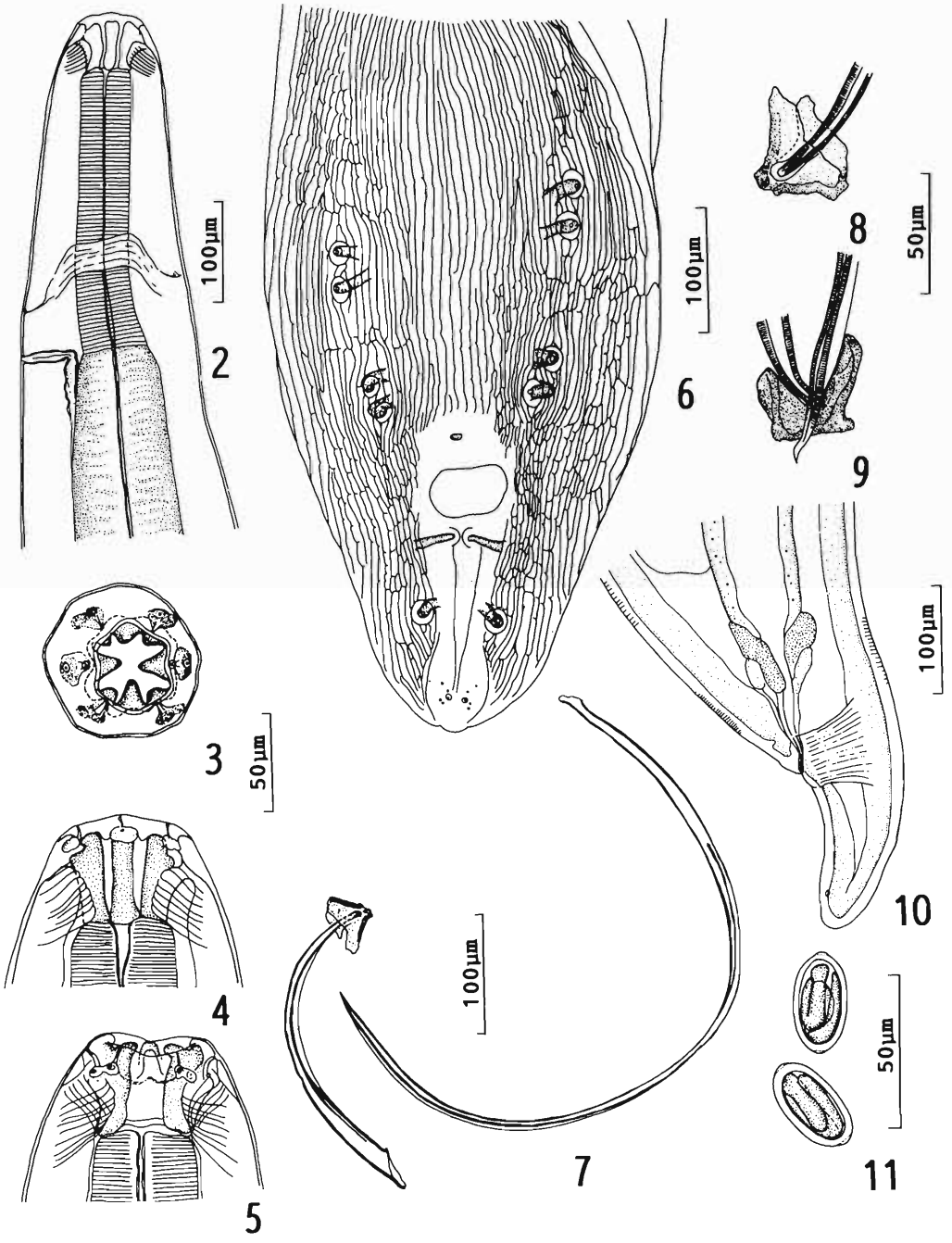
SPECIMENS: NSMT-As 2181.

REMARKS: *Cyathospirura seurati* was first described from a fennec fox, *Fennecus zerda,* in Egypt (Gibbs, 1957). However, this parasite has

Table 1. Nematode parasites collected from the rodents on Uotsuri Island, Okinawa, Japan.

Host (No. examined)	Parasite species	No. hosts infected	Intensity
Rattus rattus (12)	*Strongyloides ratti*	2	1
	Capillaria bacillata	3	—
	Nippostrongylus brasiliensis	2	1–17
	Syphacia muris	5	2–>500
	Heterakis spumosa	9	1–92
	Cyathospirura seurati	1	7
	Pterygodermatites tani	8	1–21
	Pterygodermatites whartoni	1	1
	Physaloptera sp.	5	1–6
Apodemus agrarius (2)	*Heligmonoides* sp.	2	2–10
	Physaloptera sp.*	1	1

* Third-stage larva.



Figures 2–11. ***Cyathospirura seurati*** **from** ***Rattus rattus*****. 2. Anterior part of male, left lateral view. 3–5. Anterior extremity of male, apical (3), left lateral (4), and dorsal (5) views. 6. Posterior extremity of male, ventral view. 7. Spicules and gubernaculum. 8. Gubernaculum and distal end of right spicule, left lateral view. 9. Gubernaculum and distal ends of spicules, ventral view. 10. Posterior extremity of female, left lateral view. 11. Eggs.**

Table 2. Comparison of measurements of *Cyathospirura seurati* from Japan and Australia (in micrometers unless stated otherwise).

Host Locality Specimens	*Rattus rattus* Japan Nat. Sci. Mus. NSMT-As 2181	*Vulpes vulpes* Australia Courtesy of Dr. Beveridge	*Dasyurops maculatus* Australia S. Austr. Mus. AHC 5194	*Dasyurus quoll* Tasmania S. Austr. Mus. AHC 6987
Male (No. worms measured)	(4)	(4)	(1)*	(4)
Length (mm)	6.28–8.70	7.15–8.53	10.1	7.7–10.9
Width	269–300	240–300	293	204–370
Buccal capsule length	51–59	49–63	66	63–72
Muscular esophagus				
Length	215–351	318–372	320	284–376
Width	53–74	49–59	60	49–70
Glandular esophagus				
Length (mm)	1.69–1.82	1.61–1.88	1.84	1.62–2.06
Width	129–152	103–134	180	96–160
Nerve ring†	191–254	264–280	272	268–306
Excretory pore†	194–335	324–352	384	352–420
Right deirid†	281–296	332–348	328	324–392
Left deirid†	117–170	149–168	192	176–212
Right spicule length	275–290	243–298	350	300–395
Left spicule length	720–840	693–768	995	780–1085
Gubernaculum length	38–47	37–42	42	43–49
Tail length	152–195	120–177	190	160–230
Female (No. worms measured)	(2)	(4)	(1)*	
Length (mm)	10.93–14.80	13.4–13.9	8.49	
Width	332–474	354–388	244	
Buccal capsule length	62–66	51–63	59	
Muscular esophagus				
Length	312–356	360–400	244	
Width	59–86	59–69	51	
Glandular esophagus				
Length (mm)	1.84–2.32	2.02–2.35	1.43	
Width	117–176	156–161	125	
Nerve ring†	250–281	276–304	238	
Excretory pore†	347–395	384–436	320	
Right deirid†	304–358	392–444	300	
Left deirid†	150–166	164–200	142	
Vulva (mm)†	5.23–7.48	6.03–6.90	4.40	
Tail	140–152	132–147	104	
Eggs	31–34 × 16–18	33–36 × 18–20	32–34 × 16	

* Paratypes of *Cyathospirura dasyuridis* Mawson, 1968.
† Distance from anterior extremity.

been subsequently recorded from various rodents including *R. rattus,* in Israel, Egypt, Tanzania, Formentera, and southern Spain (cf. Quentin and Wertheim, 1975; Mas-Coma and Esteban, 1983; Mas-Coma and Feliu, 1984; Gibbons et al., 1990), indicating low host specificity. The present worms are identical morphologically with the previous descriptions of *C. seurati,* although in Quentin and Wertheim (1975) the female tail is much longer (400). Gibbons et al. (1990) first noticed the faint swelling of the eggshell by scanning electron microscopic observation. They stated that the swelling was present on 1 pole. However, in the present material each pole has a swelling in most eggs. The present worms are also identical with *C. dasyuridis* from Australia. Although the distances from the anterior apex to the nerve ring, excretory pore, and deirids are somewhat longer in the Australian material (Table 2), these discrepancies may be intraspecific variations. In the previous descriptions of *C. dasyuridis,* the right spicule was slender and the left stout (Mawson, 1968; Clark, 1981). However, reexamination of the Australian material including paratypes revealed a reversed condition; i.e., the longer one is the left spicule. The swellings at poles of the eggshell were also observed in the Australian specimens.

It is thus considered that *C. dasyuridis* is a junior synonym of *C. seurati.* This is the first record of *Cyathospirura* from the Far East.

Pterygodermatites tani (Hoeppli, 1929)

Syn. *Rictularia tani* Hoeppli, 1929 (Figs. 12-17)

GENERAL: Body ornamented with paired combs subventrally. Oral opening slightly inclined dorsad, hemicircular in apical view (Figs. 12–14). Labium absent. Buccal capsule well developed, thick-walled: ventral wall with 2 large, flat teeth; lateral walls each with 3 large, round teeth; dorsal wall with 1 median tooth (Figs. 12–14). Three esophageal teeth present, 1 ventral and 2 subdorsal (Figs. 13, 14). Four large cephalic papillae, 6 small inner papillae, and amphidial pores present (Figs. 12–14). Esophagus divided into anterior muscular and posterior glandular portions (Figs. 15, 18). Nerve ring near posterior end of muscular portion of esophagus in male (Figs. 15, 18) and at middle of muscular portion of esophagus in female. Deirids at junction between muscular and glandular portions of esophagus.

MALE (2 specimens): Length 4.1–6.3 mm, width at midbody 440–442 (Fig. 15). Number of comb pairs 63–65; last several pairs small and pointed (Figs. 15, 16). Buccal depth 55–56. Muscular portion of esophagus 270–348 long by 55–59 wide; glandular portion of esophagus 1.03–1.73 mm long by 109–117 wide. Nerve ring 296, excretory pore 425, and deirids 509 from anterior extremity in male with length of 6.3 mm. Posterior end not bent ventrad (Fig. 15). Perianal region with numerous faint ridges arranged longitudinally (Figs. 16, 17). Preanal fans 3 in number, anterior 2 rudimentary, posterior 1 moderately developed (Figs. 16, 17). Tail conical, 125–160 long (Figs. 16, 17). Paired papillalike ornamentations present medially immediately anterior to anus (Fig. 17). Caudal papillae 10 pairs: 2 pairs preanal, 1 pair adanal, and 7 pairs postanal (Fig. 17). First to 4th pairs of postanal papillae set closely; 5th and 6th pairs and phasmidial pores grouped; 7th pair at tail apex (Figs. 16, 17). Spicules almost equal, simple, slightly bent ventrad: right spicule 62–78 long; left spicule 68–76 long (Figs. 16, 17).

FEMALE (8 specimens): Length 20.2–31.1 mm, width at midbody 644–900. Number of comb pairs 92–94: 42–45 pairs prevulval and 47–51 pairs postvulval; combs becoming spinelike in posterior body. Buccal depth 71–95. Muscular portion of esophagus 513–751 long by 87–119 wide; glandular portion of esophagus 2.81–4.08 mm long by 170–237 wide. Nerve ring 340–403, excretory pore 435–530, deirids 624–869, and vulva 3.33–4.84 mm from anterior extremity. Tail conical, 237–340 long. Eggs ellipsoidal, 45–47 by 29–32; thick-shelled, containing developed larvae.

HOST: *Rattus rattus.*

SITE IN HOST: Stomach and upper small intestine.

LOCALITY: Uotsuri Island, Okinawa, Japan.

SPECIMENS: NSMT-As 2182, 2183.

REMARKS: *Pterygodermatites tani* was first described from *Rattus norvegicus* in China, based on only females (Hoeppli, 1929), and subsequently redescribed by Chen (1936) and Schacher and Cheong (1960), based on males and females. The present worms agree with the previous descriptions in cephalic morphology and in having only 1 developed preanal fan and nearly equal spicules in the male. No caudal papilla was recognized in Chen (1936), and only 4 pairs of the postanal papillae in addition to 2 preanal pairs were observed by Schacher and Cheong (1960). Probably the caudal papillae were overlooked in the previous studies because of their minute size. Females of *Pterygodermatites tani* have been recorded from *R. norvegicus* on adjacent Amami and Yoron islands (Kamiya et al., 1968). *Pterygodermatites* sp., of which females are indistinguishable from *P. tani,* has been recorded from *R. rattus* on Ishigaki Island, but species identification has been withheld because its males are quite different from that of *P. tani* (Kamiya and Kanda, 1977).

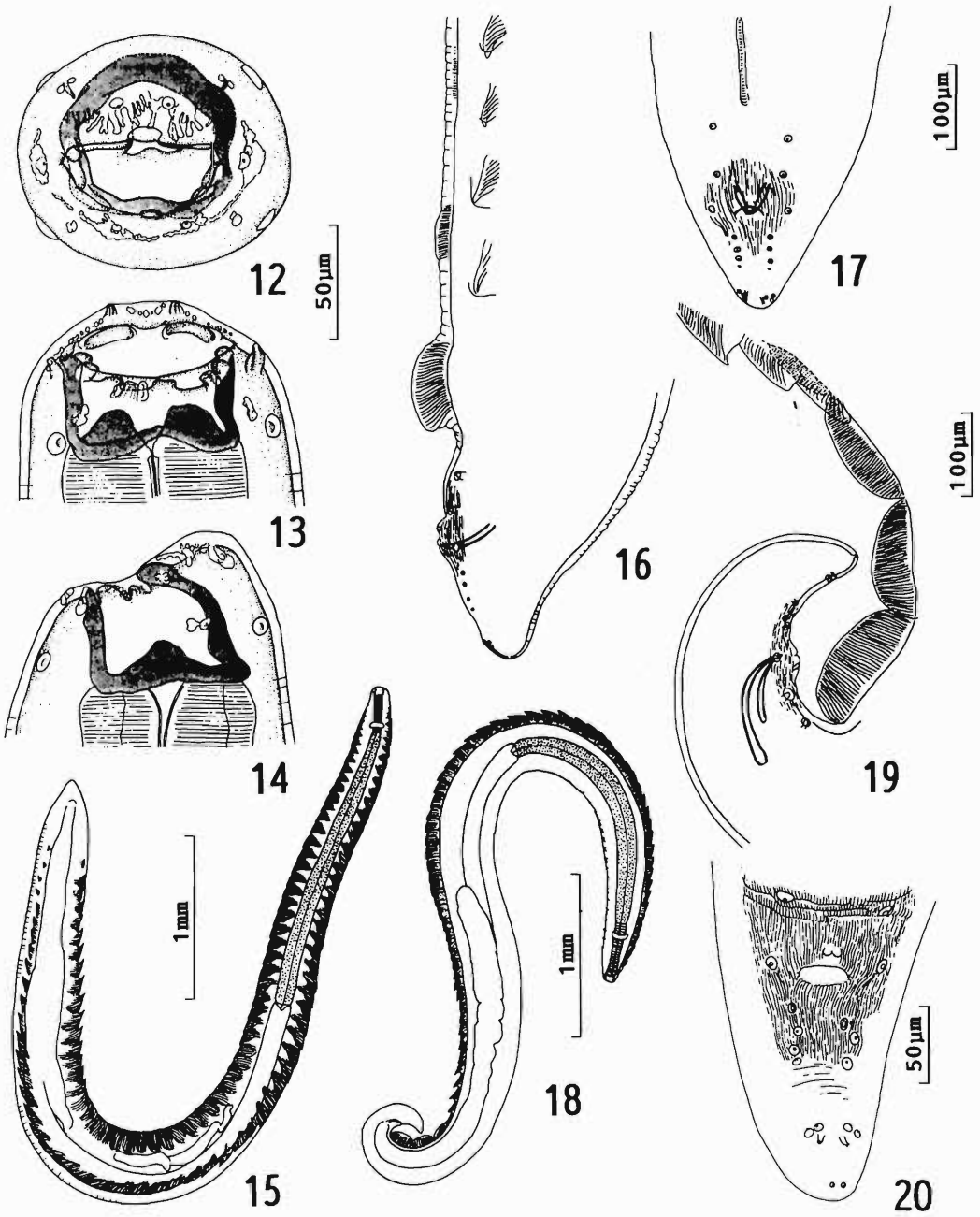
Pterygodermatites whartoni (Tubangui, 1931)

Syn. *Rictularia whartoni* Tubangui, 1931

(Nematoda: Rictularioidea: Rictulariidae) (Figs. 18–20)

GENERAL: Morphology of cephalic region was identical to that of *P. tani.*

MALE (1 specimen): Length 5.62 mm, width at midbody 400 (Fig 18). Number of comb pairs 64. Buccal depth 51. Muscular portion of esophagus 356 long by 50 wide; glandular portion of esophagus 1.52 mm long by 125 wide. Nerve ring 281, excretory pore 429, deirids 545 from anterior extremity. Posterior end bent ventrad



Figures 12–17. ***Pterygodermatites tani*** **from** ***Rattus rattus*****. 12–14. Anterior extremity of female, apical (12), dorsal (13), and right lateral (14) views. 15. Male, general view. 16, 17. Posterior extremity of male, left lateral (16) and ventral (17) views. Figures 18–20.** ***Pterygodermatites whartoni*** **from** ***Rattus rattus*****. 18. Male, general view. 19, 20. Posterior extremity of male, left lateral (19) and ventral (20) views.**

(Figs. 18, 19). Preanal fans 4 in number, posterior 3 well developed (Fig. 19). Tail conical, 192 long (Fig. 19). Perianal region with numerous faint ridges arranged longitudinally (Fig. 20). Paired papillalike ornamentations present medially immediately anterior to anus (Fig. 20). Caudal papillae 10 pairs: 2 preanal, 1 adanal, and 7 postanal (Fig. 19). First to 4th pairs of postanal papillae set closely; 5th and 6th pairs and phasmidial pores grouped; 7th pair at tail apex (Figs.

19, 20). Third papilla of postanal pairs absent on left side (Figs. 19, 20). Spicules dissimilar, simple, curved ventrad: right spicule 75 long; left 155 long (Fig. 19).

HOST: *Rattus rattus.*

SITE IN HOST: Upper small intestine.

LOCALITY: Uotsuri Island, Okinawa, Japan.

SPECIMENS: NSMT-As 2184.

REMARKS: *Pterygodermatites whartoni* was first described from only females from *R. norvegicus* in the Philippines (Tubangui, 1931), and later its male was described by Schmidt and Kuntz (1967) from a sciurid, *Sundasciurus steerii juvencus,* in the Philippines. The present male is morphologically identical to that described by Schmidt and Kuntz (1967) except that the latter has 6 postanal papillae. The last papillae at the tail tip have possibly been overlooked due to their minute sizes. Although a pair of papillalike structures at lateral sides of midtail were figured by Schmidt and Kuntz (1967), such structure was not observed in the present male. The present specimen is also identical to the males of *Pterygodermatites* sp. collected from *R. rattus* on Ishigaki Island (Kamiya and Kanda, 1977), although the unilateral double papilla described by them at level of the preanal fan was not observed.

Physaloptera sp.
(Nematoda: Physalopteroidea: Physalopteridae)

HOST: *Rattus rattus* (adult worms) and *Apodemus agrarius* (third-stage larva).

SITE IN HOST: Stomach.

LOCALITY: Uotsuri Island, Okinawa, Japan.

SPECIMENS: NSMT-As 2185, 2186.

REMARKS: The present adults from *R. rattus* are identical to those collected from *Apodemus agrarius* on Jeju Island, Korea (Hasegawa et al., unpubl.), indicating that this nematode develops to the adult stage in *Apodemus.* A detailed description of this species will be made elsewhere, on the basis of Japanese and Korean material.

Heligmonoides sp.
(Nematoda: Trichostrongyloidea: Heligmonellidae)

HOST: *Apodemus agrarius.*

SITE IN HOST: Duodenum.

LOCALITY: Uotsuri Island, Okinawa, Japan.

SPECIMENS: NSMT-As 2187.

REMARKS: The present material is identical to that recorded from *A. agrarius* at Shenyang, China (Asakawa et al., 1990); Korea, including Jeju Island; and the lowlands of Taiwan (Asakawa, pers. comm.; Hasegawa et al., unpubl.). This species resembles closely *Heligmonoides taiwanensis* Hasegawa, 1990, described from *Apodemus draco* on Mt. Alishan, Taiwan (Hasegawa, 1990). However, it differs from *H. taiwanensis* in having more cuticular ridges (28–30 in number; 24 in *H. taiwanensis*) and a less asymmetrical bursa with thinner rays. A detailed description of this species will be published elsewhere.

Discussion

Cyathospirura seurati seems to have a wide host range because it has been recorded from rodents, carnivores, and marsupials (cf. Gibbs, 1957; Mawson, 1968; Coman, 1972, 1973; Quentin and Wertheim, 1975; Gregory and Munday, 1976; Mas-Coma and Esteban, 1983; Mas-Coma and Feliu, 1984; Gibbons et al., 1990). From the Australian region this nematode has been reported as *C. dasyuridis.* Close morphological similarity between *C. seurati* and *C. dasyuridis* was noticed by Mawson (1968), who justified the latter as distinct by the host difference and geographical occurrence. However, *C. dasyuridis* was later recorded from the introduced carnivores of Tasmania and Australia (cf. Coman, 1972, 1973; Gregory and Munday, 1976). Clark (1981) presented detailed figures of the cephalic extremity and the caudal portion of *C. dasyuridis* from *Dasyurus quoll* from Tasmania, which are essentially identical to those of *C. seurati.* Beveridge (1986) presumed that the *Cyathospirura* in Australia was introduced with carnivores. This assumption may be strongly supported by the fact that *C. dasyuridis* is synonymous with *C. seurati,* as proved in this study.

Cyathospirura seurati is also closely allied to *Cyathospirura chabaudi* Gupta and Pande, 1981, which was first described in India from worms reared experimentally in pups from larvae in paratenic lizard hosts (Gupta and Pande, 1981). Gupta and Pande (1981) distinguished their species from *C. seurati* only on the basis of comparison to the description by Gibbs (1957). However, when compared to the redescription of *C. seurati* by Quentin and Wertheim (1975), the difference between the 2 species is slight except that *C. chabaudi* has a smaller body but somewhat longer spicules. It is probable that the smaller body of *C. chabaudi* is due to the younger stage of the worms, because molting larvae and immature adults as well as mature adults were also

recovered from the pups (Gupta and Pande, 1981). It is thus strongly suggested that *C. chabaudi* is a junior synonym of *C. seurati.* Unfortunately, the type specimens of *C. chabaudi* were not available for comparison in spite of every effort. If *C. chabaudi* is synonymous with *C. seurati,* it is then apparent that this spirurid is widely distributed in Africa, Eurasia, and Australia at the present time. However, its distribution in the Far East may be sporadic, because no record of a species of *Cyathospirura* has been established from adjacent areas of Uotsuri Island. The route by which *C. seurati* came to this island remains to be elucidated.

The taxonomical relationship between *P. tani* and *P. whartoni* has puzzled many researchers. Chen (1936) and Schacher and Cheong (1960) considered *P. whartoni* to be a junior synonym of *P. tani* because there was no clear distinguishable characteristic in female morphology between the 2 species. However, Schmidt and Kuntz (1967) claimed the validity of *P. whartoni* because they found a male apparently different from that of *P. tani* described previously. Kamiya and Kanda (1977) also detected *Pterygodermatites* sp. of which the female is indistinguishable from *P. tani* whereas the male is identical to *P. whartoni.* The presence of the 2 closely related species, of which females are actually indistinguishable from each other, in a rat on a small uninhabited island such as Uotsuru Island seems to be quite curious. The same situation was also observed on Lanyu Island, Taiwan, where males of both *P. tani* and *P. whartoni* were collected from *R. rattus* (Hasegawa et al., unpubl.). It is thus strongly probable that *P. tani* has 2 types of males, 1 of which has been regarded as *P. whartoni.*

A similar condition was observed in males of *Rictularia cristata* Froelich, 1802, collected from *Apodemus* spp. of China and Japan (Hasegawa and Asakawa, unpubl.). Because rictulariid males are minute, and usually much fewer in number than females, their morphology has not been described adequately in many species. The length and length ratio of the spicules have been considered as important taxonomic characters of rictulariids (cf. Quentin, 1969). If male dimorphism is a common phenomenon, then a thorough critical revision of the rictulariids may be required. Further studies may also be necessary to confirm the dimorphism of male rictulariids. In some parasitic nematodes, male dimorphism has been already reported (cf. Chabaud and Golvan, 1957; Hasegawa, 1985; Lichtenfels and Pilitt, 1989; Ainsworth, 1990), although its ecological or evolutionary significance has not yet been elucidated.

Physaloptera sp. might have been introduced to Uotsuri Island by 1 of the 2 rodent species. It seems less probable that *R. rattus* introduced this nematode because no physalopterid has been recorded from rats on the adjacent islands (cf. Kamiya et al., 1968; Kamiya and Machida, 1977), whereas the same species has been collected from *A. agrarius* on Jeju Island, Korea (Hasegawa et al., unpubl.). Moreover, Kontrimavichus and Khokhlova (1964) recorded *Physaloptera* sp. from *Apodemus* in the Far East territory of Russia, and Zhang (1985) recorded a physalopterid species from *A. agrarius* in China. It is thus suggested that *Physaloptera* sp. was introduced by *A. agrarius* and subsequently adapted to *R. rattus.* If more individuals of *A. agrarius* on Uotsuri Island are examined, mature *Physaloptera* sp. may be obtained.

Heligmonoides sp. of *A. agrarius* is considered to have arrived in Uotsuri Island with its host, because this nematode has been detected only from *A. agrarius* (Asakawa et al., 1990; Asakawa and Hasegawa, unpubl.). From other *Apodemus* species of the adjacent areas, different *Heligmonoides* species have been recorded: *H. taiwanensis* Hasegawa, 1990, from *A. draco* of Taiwan and *Heligmonoides speciosus* (Konno, 1958) from *Apodemus* spp. of the mainland of Japan (cf. Hasegawa, 1990). The close resemblance between the present *Heligmonoides* sp. and *H. taiwanensis* suggests that both nematodes were derived from a common ancestor adapted to *Apodemus.*

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